



## Clinical and functional results of anterior cruciate ligament reconstruction using the medial portal technique

### Ön çapraz bağ tamirinde kullanılan medial portal tekniğin klinik ve fonksiyonel sonuçlara etkisi

Ligament reconstruction

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#### Öz

**Amaç:** Bu çalışmada hamstring otogreft ile medial portal anatomik ön çapraz bağ (ÖÇB) rekonstrüksiyonu sonrası klinik ve fonksiyonel sonuçları retrospektif olarak araştırmaktır. **Gereç ve Yöntem:** Çalışmaya ön çapraz bağ yırtığı nedeniyle rekonstrüksiyon yapılan 47 hasta (Ort. yaş: 26,5; dağılım 18-48) alındı. Tüm hastalar artroskopik olarak otogreft hamstring tendonu, proksimal tespit Endobutton sistemi ve tibial tarafta biokompozit interferans vidası ile tedavi edildi. Bütün hastalara postoperatif dönemde hızlandırılmış iyileştirme programları uygulandı. Hastalar ameliyat öncesi ve sonrası klinik ( tek bacak zıplama testi, Lachman testi, öne çekmece testi, pivot-shift testileri) ve fonksiyonel skorlar ( Lysholm skoru ve Tegner aktivite skoru) ile takip edildi. **Bulgular:** Tüm hastaların diz fonksiyonel değerlendirilmesinde Lysholm skoru ortalama preoperatif 62,4±8,6 iken postoperatif 91,2±7,5 oldu. Tegner aktivite skoru preoperatif ortalama 3,4±0,9 iken postoperatif 5,4±1,2 oldu. Son kontrolde kas atrofisi farkı ortalama 3,2±1,2 cm olduğu görüldü. Tek bacak zıplama testi, Lachman testi, Pivot shift testi ve ön çekmece testi sonuçlarına göre tüm hastalarda klinik olarak anlamlı iyileşme tespit edildi. Bir hastada travma nedeniyle tekrar rüptür gelişti ve bu hastaya Tibialis anterior tendon allogrefti ile rekonstrüksiyon yapıldı. **Tartışma:** ÖÇB rekonstrüksiyonu yapılırken medial portal yönteminin kullanılması sadece ön-arka stabilite değil aynı zaman da rotasyonel stabiliteyi de arttırmaktadır. Bu yöntemin kullanılması klinik ve fonksiyonel sonuçlarının daha başarılı olmasını sağlayabilir.

#### Anahtar Kelimeler

Ön Çapraz Bağ Rekonstrüksiyonu; Medial Portal; Otojen Hamstring Tendon Grefti

#### Abstract

**Aim:** In this study, a retrospective evaluation was made of the functional and clinical results of anterior cruciate ligament reconstruction using the medial portal technique. **Material and Method:** The study included 47 patients (mean age=26.5, between 18-48 years old) who had anterior cruciate ligament reconstruction. All patients were treated with arthroscopic autograft hamstring tendon, proximal fixation with the Endobutton system and a biocomposite interference screw in the tibia. Postoperatively, an accelerated improvement program was applied to all patients. The evaluation was made of the clinical and functional scores (Lysholm score and Tegner activation score) before and after the operation in all patients. **Results:** The mean Lysholm score was 62.4±8.6 preoperatively and 91.2±7.5 postoperatively. The mean Tegner activation score was 3.4±0.9 preoperatively and 5.4±1.2 postoperatively. According to the results of the single-leg hop test score, Lachman test, Pivot shift test and anterior drawer test, significant healing was determined in all patients. In one patient, rupture occurred because of trauma and reconstruction was applied with tibialis anterior tendon allograft. **Discussion:** Medial portal anatomical reconstruction of ACL is an effective method to improve clinical and functional results.

#### Keywords

Anterior Cruciate Ligament Reconstruction; Medial Portal; Autogenous Hamstring Tendon Graft

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## Introduction

Throughout the world, the most common ligament injury around the knee is anterior cruciate ligament (ACL) injury. Thus, ACL reconstruction is one of the most commonly performed operations by orthopedic surgeons. This injury has been shown to cause effusion in the joint, muscle weakness, joint instability, pain and the early development of osteoarthritis within 10-20 years [2-3-4]. Treatment of ACL injuries is made conservatively and surgically. In the conservative treatment of ACL injuries, activity modification, muscle strengthening exercises, the use of a brace and the avoidance of activities requiring high physical performance are preferred for patients with a sedentary lifestyle [5, 6]. However, in current treatment methods, there is an increase in surgery for young patients, those engaged in sports, active individuals and those who undertake physical work [1, 2, 7]. The most preferred and up-to-date method in surgical treatment is medial port anatomic ACL reconstruction with hamstring autograft [7].

In this study, a retrospective evaluation was made of the clinical and functional results of anatomic ACL reconstruction with hamstring autograft with the aim of determining the factors affecting the return to the pre-trauma level of activity of the patients.

## Material and Method

Of 79 patients who underwent anatomic arthroscopic ACL reconstruction using the medial portal at Bepazari State Hospital between 2009 and 2014 and met the study criteria, a total of 47 patients were included in the study. Patients were excluded if they had multiple ligament injuries, total meniscectomy, injury of the contralateral knee or lower extremity, if the trauma was a workplace accident, if they were aged >50 years or if records were not available. The clinical evaluation was applied with knee joint range of movement, the Lachman test, the anterior drawer test, the pivot shift test, single-leg hop and measurements of the thigh circumference. Functional evaluation was applied with the Lysholm score and the Tegner activity score.

## Statistical Evaluation

The preoperative, intraoperative and end of follow-up data were recorded and analyzed using SPSS in 15.0 for Windows software. The Student's t-test was applied in the statistical evaluations. A value of  $p < 0.05$  was accepted as statistically significant.

## Surgical Technique

At 30 mins before the operation, all patients were administered with 1 gr first-generation cephalosporin as prophylaxis and this prophylactic antibiotic was continued for 24 hrs in the postoperative period until the drain was removed. For confirmation of the ACL tear, arthroscopic evaluation of the knee was applied under general or regional anesthesia, under a pneumatic tourniquet with the patient in a supine position. By revealing accompanying pathologies, the necessary treatments were applied arthroscopically. Using a 3cm longitudinal incision over the pes anserinus in the medial of the tuberositas tibia, the Gracilis and semitendinosus tendons were reached.

After the tendons were removed with a tendon stripper, adhered muscle tissues were cleaned. The graft diameter was defined by folding the tendon into four layers. From the medial portal, the anatomic femoral tunnel and then the tibial tunnel was prepared suitable for this diameter, and the graft was placed in the tunnels under guidewire guidance (Figures 1a, 1b). In the proximal, the graft was fixed to the femur with the Endobutton system (Toggleloc ZipLoop, Bioment Sport Medicine). In the distal, with the knee in 10°-20° flexion and holding the graft stretched, fixation of the graft inside the tibial tunnel was made with a biocomposite interference screw (Bioment Sport Medicine) and 1 staple U nail.

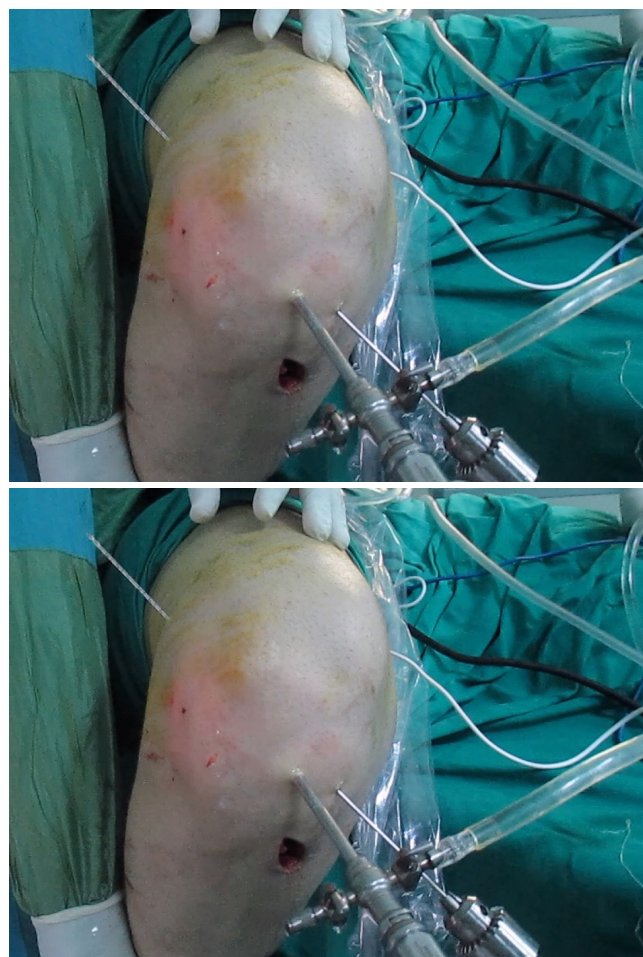


Figure 1: Tunnel preparation (a) and placement of the graft in the tunnels (b) in anatomic medial port ACL surgery.

## Postoperative Follow-Up Protocol

Isometric quadriceps strengthening and flexion exercises were started immediately in all patients. The patients were mobilized with weight-bearing as tolerated with crutches and a knee brace. Daily activities were permitted in a gradually increasing manner up to the 4th week. Compulsory early rehabilitation was started in all patients. In cases with muscle atrophy and functional knee failure, an advanced level of physical rehabilitation was applied. After the postoperative 6th month, sport and active exercises were permitted.

## Additional Surgery Applied

In 17 patients, there was a meniscus tear on the medial side,

in 5 patients on the lateral side and in 1 patient, on both lateral and medial sides. Partial meniscectomy was applied to 11 of the patients with meniscus injury, and in 23 patients, the meniscus was sutured using the all-inside technique (Sequent, Linvatec). In 3 patients with a cartilage defect, mosaicplasty was performed (Cor, Depuy). Medial parapatellar plica excision was applied in 16 patients. Due to intra-articular effusion which developed during the follow-up period, effusion drainage was applied to 3 patients. Rupture developed in 1 patient because of trauma and reconstruction was applied with anterior tibial tendon allograft. No neurovascular complications developed in any patient.

## Results

The patients comprised 35 males and 12 females with a mean age of 26.5 years (range, 18-48 years). ACL tear was present in the right knee of 39 patients and in the left knee of 8 patients. The cause of the injury was a sports injury in 36 patients, the result of an old trauma in 9 patients and other reasons in 2. In the functional evaluation of all the patients, the mean Lysholm score was  $62.4 \pm 8.6$  preoperatively and  $91.2 \pm 7.5$  postoperatively. The mean Tegner activity score was  $3.4 \pm 0.9$  preoperatively and  $5.4 \pm 1.2$  postoperatively. The functional scores of all the patients were found to have statistically significantly improved. According to the results of the single-leg hop test, the Lachman test, the Pivot shift test and the anterior drawer test, a clinically significant level of improvement was determined. At the final follow-up examination, the difference in muscle atrophy was measured as mean  $3.2 \pm 1.8$  cm (Table 1).

Table 1. The clinical and functional results of the patients preoperatively and at the final follow-up examination

|   | Preoperative   | Postoperative              | p     |
|---|----------------|----------------------------|-------|
| Lysholm score (mean)                        | $62.4 \pm 8.6$ | $91.2 \pm 7.5$             | <0.05 |
| Tegner activity score (mean)                | $3.4 \pm 0.9$  | $5.4 \pm 1.2$              | <0.05 |
| Difference in thigh circumference (mean cm) | $1.9 \pm 1.3$  | $3.2 \pm 1.8$              | <0.05 |
| Single-leg hop score<br>1/2/3/4             | -              | 1/0<br>2/0<br>3/10<br>4/37 |       |
| Lachman score (0/1/2/3)                     | 0/9/22/16      | 39/7/1/0                   | <0.05 |
| Pivot shift test                            | 43             | 4                          | <0.05 |
| Anterior drawer test (0/1/2/3)              | 0/7/25/15      | 37/9/1/0                   | <0.05 |

Lysholm score: Excellent, Good, Moderate, Poor

Tegner activity score: 1/2/3/4/5/6/7/8/9/10

Single-leg hop test score: 1: %50 ve alti, 2: %50-75, 3: %75-90, 4: %90 ve üzeri

Lachman test: 0: absent, 1: +, 2: ++, 3: +++

Pivot-shift test: - Negative + Positive

## Discussion

ACL injuries can be treated with conservative or surgical treatment. The risk of osteoarthritis developing in these patients within 10-20 years is increased by 50%. As a result of osteoarthritis, there may be pain and function loss [4]. However, developments have been recorded in surgical treatment in the last 10 years due to the demand of young, active patients to regain knee functions and return to pre-injury activity levels in the early period [8]. The patients included in this study underwent surgical treatment as the instability of the knee affected daily

living activities, and they wished to return to pre-injury activity levels.

The ACL forms two bundles related to the tibia and femur adhesion sites. The anteromedial bundle supports the anteroposterior stability of the knee, and the posterolateral bundle contributes to rotational stability. Therefore, in ACL reconstruction, not only the anteroposterior stability but also rotational stability must be taken into consideration. Anatomic ACL reconstruction from the medial portal is a method which can provide both anterior-posterior and rotational stability. The most commonly used and most up-to-date method of ACL repair is medial portal anatomic ACL reconstruction with hamstring autograft [7,9]. There has been increased importance placed on the rapid return to re-injury activities of patients. To achieve this, postoperative rehabilitation protocols have shown a significant degree of development and mandatory early rehabilitation has started to be more accepted [10,11]. It has been recommended particularly for a rapid return to sports within 6 months following ACL reconstruction [12,13]. In the current study, as the patients were young and active, surgical treatment was recommended. Mandatory early rehabilitation was started quickly postoperatively. The results of this study showed statistically successful clinical and functional results. In patients applied with ACL reconstruction, post-traumatic stress disorder is seen more in those with sports injuries. Studies have shown that although there are several factors affecting athletes at the time that they are doing sport, the most important are psychological factors [14,15]. Most of the current study patients had concerns that they would not be able to return to their pre-injury level of activity. An intensive physical therapy program and psychological support increase compliance in these types of patients.

Quadriceps muscle atrophy is seen in most ACL reconstruction patients. In literature, muscle atrophy and weakness has been reported to be the most common complication [16,17] and insufficient hamstring-quadriceps muscle strength, motor coordination and proprioception can continue for up to a year. The main reason for quadriceps weakness is not donor site morbidity, but an impairment of the neuromuscular activation systems [18,19]. In a study by De Long et al., following ACL construction made with hamstring tendon graft, severe loss of strength was reported in the quadriceps muscle, and although this loss decreased between 6-12 months postoperatively, it continued to be lower than the preoperative level [20]. In the current study, muscle atrophy was seen in 75% of patients. This patient group requires intense physical rehabilitation.

Physical therapy and rehabilitation plays a significant role in clinical success following ACL reconstruction. Modern treatment methods and rehabilitation protocols for a return to sport and pre-injury activity level have become available and widespread [21]. Although there are differences in physical treatment and rehabilitation programs, accelerated programs are preferred to regain the earliest movement, muscle strength, and knee function and to encourage an early return to sport and an active lifestyle [10,11,22]. In the current study, an accelerated physical treatment protocol was applied to patients immediately after the operation. Joint range of motion exercises to strengthen the quadriceps and hamstring muscle groups with closed kinetic chain exercises were applied routinely to all

patients. Those who were thought to have weakness in the extensor muscle groups were given professional physical therapy and rehabilitation. It can be considered that the application of physical rehabilitation by a professional team to every patient who has undergone ACL reconstruction could increase the success of the operation and accelerate the return to work and an active lifestyle.

There is a high occurrence of the combination of meniscus and cartilage injuries together with ACL tears, and this has been determined to affect the healing process after surgery. Early surgical treatment is recommended particularly in the first 6 months [23,24]. In patients with delayed ACL reconstruction together with meniscus and cartilage lesions, there has been seen to be a negative effect on surgical treatment results [25]. In the current study, the clinical and functional results were not seen to have been negatively affected in patients with meniscus and chondral lesions. This could be attributed to the application of surgery in the early period, the application of meniscus repair and treatment of severe cartilage lesions with mosaicplasty in 3 patients. Furthermore, that these patients did not return to active sports and activities for a period of 3 months could have ensured completion of the healing process of internal knee injuries.

The single-leg hop test is the best test to evaluate knee functions in return to the sport of ACL reconstruction patients [26]. When making the decision for the current study patients to return to active sport and pre-trauma activities, permission was granted to those who could achieve >75% in the knee stability tests and single-leg hop test. No problems were encountered in the return of patients to pre-injury activities. With ACL tear, the positional feeling in the knee joint and proprioception are reduced. No specific exercise program for proprioception was applied.

In conclusion, by providing an entry close to the anatomic site of the femoral tunnel, the use of the medial port method when performing ACL reconstruction, increases not only the anterior-posterior stability but also rotational stability. However, the period of rehabilitation is lengthy due to muscle atrophy and hematoma-effusion within the knee, which are the most important factors affecting the return to pre-trauma activity level in patients with ACL reconstruction. The results of this study demonstrated that the clinical and functional results of medial portal anatomic ACL reconstruction are extremely successful. The most important limitations of the study were that it was retrospective and the K-T dynamometer knee stability test was not applied. Furthermore, there was no application or evaluation of proprioception exercises.

#### Human Rights Statement

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Animal Rights Statement: Nonapplicable.

Conflict of Interest Statement

The authors have no conflict of interest.

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#### Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

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